

Roger was particularly interesting in that it followed closely on the heels of Typhoon Pamela (27). Both systems remained south of the subtropical ridge axis, moved to a mid-tropospheric neutral point near northern Luzon and were profoundly affected by the passage of a mid-latitude trough. In sharp contrast to Pamela, which was a long-lived, significant tropical cyclone, Roger remained an incipient circulation for four days, and required three Tropical Cyclone Formation Alerts (TCFA) before attaining warning status on 7 December.

The first hint of formation occurred at 030600Z when a large area of convection appeared in an upper-level divergence pattern 1200 nm (2222 km) southeast of Typhoon Pamela. This pattern persisted aloft and drifted west-northwestward at 240 nm (444 km) per day. The low-level circulation center was displaced 150 nm (278 km) south of the cloud

system center. This incongruity, or tilt, was present until 7 December and was, most probably, responsible for the long period of slow development.

The persistent convection feeding an outflow pattern aloft developed into a cloud system center, which prompted a TCFA at 042000Z and its reissuance for relocation at 050800Z. Development was arrested late on 5 December and the TCFA was cancelled at 060600Z. The upper-level mechanism (troughing off Asia) that was inhibiting Roger's development (in addition to contributing to its vertical tilt) was also affecting Pamela. During this period, Pamela slowed its forward motion, weakened, and changed course from the northwest to the southwest along the periphery of the northeast monsoon. By 061600Z Pamela and (formative) Roger had approached to within 600 nm (1111 km) of each other.

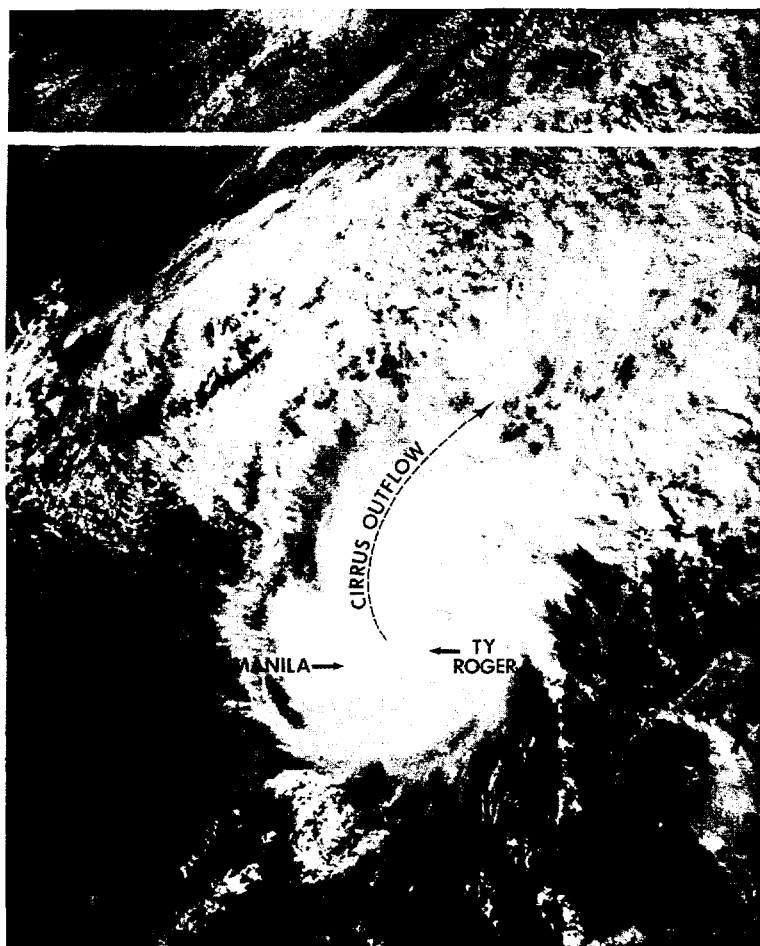


Figure 3-28-1. Expanded visual data of Roger just after reaching typhoon strength off the east coast of Luzon. The extensive low-level cloud deck to the north and northwest of the typhoon's cirrus outflow is embedded in the northeast monsoon. 090627Z December (NOAA 7 visual imagery)

During the next 24 hours the conditions for tropical cyclone development were favorable. Rawinsonde data from southwestern Taiwan (Tung-Chiang, Taiwan (WMO 46747)) indicated a 40 m height rise at 500 mb and reduced vertical wind shear. While Pamela moved into the central Philippines and weakened, Roger remained over water and underwent rapid intensification. The low-level wind circulation center and the cloud system center became vertically aligned and Roger gained tropical storm strength at 071200Z. Because of the sparse conventional data and the system's small maximum wind radius, the Joint Typhoon Warning Center could not verify the change in vertical alignment. As a reconnaissance aircraft deployed, a TCFA was issued at 072000Z. The first fix from the aircraft indicated a small, tight, 50 kt (26 m/sec) circulation with a minimum central pressure of 1002 mb, which prompted the initial warning at 080000Z.

Roger continued to move toward the northwest along the coast of the Philippines and intensified to typhoon strength at 090000Z. At 091200Z the 500 mb heights to the north at Tung-Chiang (WMO 46747) began to fall due to an approaching mid-latitude trough; the 700 mb flow had changed from northerly to southerly and the low-level northeast monsoonal flow weakened. Roger weakened to tropical storm intensity and moved northward along the east coast of northern Luzon. Satellite imagery revealed that a long cirrus plume was developing from Roger and streaming northeastward as the vertical shear increased aloft.

Increasing vertical shear, the approaching trough, and southerly low-level steering flow hinted at both recurvature (with sudden acceleration) and rapid shearing. Because of Roger's close proximity to land, aircraft reconnaissance was unable to monitor which scenario was taking place and, as a result, satellite data became the major input to the warnings. This posed a problem for the satellite analysts who could only position the top of the cloud system, which was becoming featureless and shearing off to the east. By 100600Z the cloud system center had been poorly organized for 12 hours and the apparent location of the low-level circulation center was highly suspect. Fortunately, by this time Roger had sufficient land clearance for the aircraft to be used. The fix located a greatly weakened center just off the northeastern tip of Luzon. These data required amendment of the 100600Z warning; downgrading Roger to a tropical depression, and relocating the circulation center 80 nm (148 km) to the northwest. The increasing vertical shear caused by the mid-latitude trough dropping southeastward across mainland China had disrupted the vertical linkage between the upper- and lower-level circulations and displaced the convection to the southeast.

The remains of the system were monitored for regeneration until 101800Z when the final warning was issued. The exposed low-level center continued to track northeastward for a day and was ingested into the frontogenic zone east of Taiwan.